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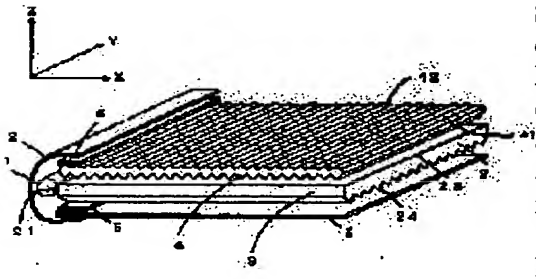
(54) PRISM SHEET AND PANEL LIGHT SOURCE ELEMENT



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a panel light source element and a prism sheet using the panel light source element, in which distribution of emitting light is controlled in a narrow range, gradation inversion is difficult to take place in a liquid crystal element, and luminance is very high.

SOLUTION: This panel light source element includes a light deflecting element 4 disposed on a light emitting surface 23 of a light guide body 3. Light entering and emitting sides of the light deflecting element 4 have prism row arranging surfaces on which a plurality of prism rows having substantially triangular sections are arranged in parallel to each other, respectively, whose ridgelines on the light entering and exiting sides are substantially parallel to each other, whose peak angles on the light entering side are 50 to 80°, whose peak angles on the light emitting side are 140 to 170°, and which are substantially parallel to a light entering surface of the light guide body 3.

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[Claim(s)]

[Claim 1] The transparent material which has the optical outgoing radiation side which carries out an abbreviation rectangular cross with at least one optical plane of incidence and this which counter the light source and this light source, and has the optical outgoing radiation device to which outgoing radiation of the light which carries out incidence from the light source is carried out from an optical outgoing radiation side, It consists of an optical deflection component arranged on the optical outgoing radiation side of a transparent material, and a light reflex component arranged at the rear face which counters the optical outgoing radiation side of a transparent material. Said optical deflection component has the prism train array side where many cross-section abbreviation triangle-like prism trains were arranged by juxtaposition at the light entering surface and light exiting surface side. The ridgeline of the prism train by the side of a light entering surface and a light exiting surface mutually by abbreviation parallel The surface light source component which the vertical angle of the prism train by the side of a light exiting surface is [the vertical angle of the prism train by the side of a light entering surface] 140-170 degrees at 50-80 degrees, and is characterized by being arranged so that a prism train may become the optical plane of incidence of a transparent material, and abbreviation parallel.

[Claim 2] The surface light source component according to claim 1 to which the include angle of peak light is characterized by luminous-intensity half-value width being 10-40 degrees at 50-80 degrees to the normal of an optical outgoing radiation side in the field where the distribution of outgoing radiation light which carries out outgoing radiation from said transparent material is perpendicular to the both sides of optical plane of incidence and an optical outgoing radiation side.

[Claim 3] A surface light source component given in either of claims 1 and 2 characterized by forming in one [at least] field of the optical outgoing radiation side of said transparent material, and its rear face the lens side where a split face or many lens trains were formed in an optical outgoing radiation side and abbreviation parallel.

[Claim 4] The surface light source component according to claim 1 to 3 characterized by forming in one [at least] field of the optical outgoing radiation side of said transparent material, and its rear face the lens train of a large number prolonged in an abbreviation perpendicular to optical plane of incidence.

[Claim 5] The surface light source component according to claim 4 to which the lens train of a large number formed in said transparent material is characterized by being the prism train of 60-150 degrees of vertical angles by the shape of a cross-section abbreviation triangle.

[Claim 6] The surface light source component according to claim 1 to 5 characterized by locating the location of the ridgeline of the prism train which the pitch of the prism train by the side of the light entering surface of said optical deflection component and a light exiting surface is abbreviation identitas, and counters in 20% or less of range of the pitch of a prism train.

[Claim 7] The surface light source component according to claim 6 characterized by the location of the ridgeline of the prism train which counters being mostly in agreement.

[Claim 8] Said optical deflection component is a surface light source component according to claim 1 to 7 characterized by the distance of the valley of the prism train by the side of a light entering surface and the prism train by the side of a light exiting surface which counters being 3 or less times of the pitch of a prism train.

[Claim 9] Said optical deflection component is a surface light source component according to claim 1 to 8 characterized by consisting of a sheet-like object of one sheet with which the prism train by the side of a light entering surface and a light exiting surface was formed in both sides of a transparence base material, respectively.

[Claim 10] The prism sheet characterized by the ridgelines of the prism train which two or more prism trains of the shape of a cross-section abbreviation triangle of 50-80 degrees of vertical angles are formed in one front face of a transparence base material, and two or more prism trains of the shape of a cross-section abbreviation triangle of 140-170 degrees of vertical angles are formed in the field of another side,

and was formed in both fields being abbreviation parallel mutually.
[Claim 11] The prism sheet according to claim 10 characterized by locating the location of the ridgeline of the prism train which the pitch of the prism train formed in said both sides is abbreviation identitas, and counters in 20% or less of range of the pitch of a prism train.
[Claim 12] The prism sheet according to claim 11 characterized by being arranged so that the location of the ridgeline of the prism train which counters may be mostly in agreement.
[Claim 13] The prism sheet according to claim 9 to 12 characterized by the distance of the valley of the prism train formed on the surface of one side and the prism train formed in the field of another side which counters being 3 or less times of the pitch of a prism train.

[Detailed Description of the Invention]
[0001]
[Industrial Application] About the prism sheet used for the surface light source component of an edge light method and it which are used for liquid crystal displays, such as a notebook computer and a liquid crystal television, distribution of outgoing radiation light is controlled very narrowly in more detail, and this invention relates to the prism sheet used for the surface light source component and it which have high brightness.
[0002]
[Description of the Prior Art] In recent years, the color liquid crystal display has been widely used in various fields, such as a liquid crystal television which used monitors, such as a portable notebook computer and a personal computer, and an electrochromatic display panel, or a video one apparatus liquid crystal television. Moreover, big-screen-izing of a liquid crystal display and highly minute-ization are briskly advanced with increase-izing of the amount of information processing, diversification of needs, multimedia correspondence, etc.
[0003] The liquid crystal display consists of the back light section and the liquid crystal display component section fundamentally. There is a thing of the edge light method which has arranged the light source so that the side edge side of the thing of a direct lower part type or a transparent material which has arranged the light source directly under the liquid crystal display component section may be countered as the back light section, and the edge light method is used abundantly from a viewpoint of miniaturization of a liquid crystal display.
[0004] In the case of the liquid crystal display which used such a back light, the liquid crystal molecule within a liquid crystal cell is twisted at 90 degrees or a still bigger include angle, the polarization shaft of the linearly polarized light light which carried out incidence into the cel is rotated, by the polarization shaft orientation of the polarizing element arranged at the outgoing radiation side of a cel, transparency or cutoff of light is performed and the display of a screen is made. However, since, as for the light which carries out incidence into a liquid crystal cell from the usual back light, distribution exists in an incident angle, the rotational degree which receives each light from the torsion of the liquid crystal in a cel changes with include angles of distribution, and the transparency at the time of passing a polarizing element or the degree of cutoff changes with include angles of distribution of incident light. For this reason, according to the direction which looks at the screen of a liquid crystal display, brightness will differ from a hue and the phenomenon of characteristic tone reversal arises in a liquid crystal display.
[0005]
[Problem(s) to be Solved by the Invention] Various approaches are proposed in order that such brightness and a hue may carry out an unevenness improvement. For example, the method of dividing the one interior of a liquid crystal cell into two or more domains, and adjusting the torsion of the liquid crystal molecule inside the divided cel to the angular distribution of a light on either side, There are what makes the direction of orientation a radial for the torsion of a liquid crystal molecule within one liquid crystal cell, a thing to which a drive electrode is arranged in parallel with a liquid crystal cell base, and orientation of the liquid crystal molecule is carried out in parallel, a method of leaning the refractive-index shaft of a phase contrast plate, and compensating gap of a phase, etc.
[0006] However, while using the liquid crystal cell of a complicated special structure by these approaches, making the orientation of the liquid crystal molecule carry out in the special direction, or using a special phase contrast plate and being inferior to the productivity of a liquid crystal display, it had the trouble that an expensive special member had to be used.
[0007] Then, the purpose of this invention is to offer the prism sheet used for the surface light source component and it which have high brightness while it is controlled very narrowly, and distribution of outgoing radiation light is [the tone reversal of a liquid crystal display] lifting-hard and carries out it.
[0008]

[The means for making a technical problem solved] By extending the outgoing radiation light which this invention person etc. made carry out incidence of the very narrow collimation light of distribution to a liquid crystal cell in view of such a situation, and carried out outgoing radiation from the liquid crystal cell by a diffusion member etc. A header and this invention are reached in the thing of very narrow distribution which it is collimation-ized and is done for the outgoing radiation of the light by being able to offer the liquid crystal display which has a large angle of visibility and tone reversal cannot produce easily, and using the optical deflection component of specific structure.
[0009] Namely, the transparent material which the surface light source component of this invention has the optical outgoing radiation side which carries out an abbreviation rectangular cross with at least one optical plane of incidence and this which counter the light source and this light source, and has the optical outgoing radiation device to which outgoing radiation of the light which carries out incidence from the light source is carried out from an optical outgoing radiation side, It consists of an optical deflection component arranged on the optical outgoing radiation side of a transparent material, and a light reflex component arranged at the rear face which counters the optical outgoing radiation side of a transparent material. Said optical deflection component has the prism train array side where many cross-section abbreviation triangle-like prism trains were arranged by juxtaposition at the light entering surface and light exiting surface side. The ridgeline of the prism train by the side of a light entering surface and a light exiting surface mutually by abbreviation parallel The vertical angle of the prism train by the side of a light entering surface is 50-80 degrees, and the vertical angle of the prism train by the side of a light exiting surface is 140-170 degrees, and it is characterized by being arranged so that a prism train may become the optical plane of incidence of a transparent material, and abbreviation parallel. Moreover, the prism sheet of this invention is characterized by the ridgelines of the prism train which two or more prism trains of the shape of a cross-section abbreviation triangle of 50-80 degrees of vertical angles are formed in one front face of a transparence base material, and two or more prism trains of the shape of a cross-section abbreviation triangle of 140-170 degrees of vertical angles are formed in the field of another side, and was formed in both fields being abbreviation parallel mutually.
[0010]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, making a drawing reference. Drawing 1 shows one typical operation gestalt of the surface light source component of this invention. As shown in drawing 1 the surface light source component of this invention The transparent material 3 which makes one front face which makes at least one side edge side the optical plane of incidence 21, and carries out an abbreviation rectangular cross with this the optical outgoing radiation side 23, It consists of the light source 1 which countered the optical plane of incidence 21 of this transparent material 3, has been arranged, and was covered with the light source reflector 2, an optical deflection component 4 arranged on the optical outgoing radiation side of a transparent material 3, and a reflective component 5 arranged at the rear face 24 of the optical outgoing radiation side 23 of a transparent material 3. In addition, six in drawing is a shielding material for preventing the nearby bright line and a nearby dark line in the lamp case, and can be installed if needed.
[0011] The transparent material 3 is arranged at XY side and parallel, and is making the shape of a rectangle as a whole. The transparent material 3 has four side edge sides, among those makes side edge at least 1 of one pair of side edge sides which are parallel to YZ side, counter mutually, and are arranged the optical plane of incidence 21. The optical plane of incidence 21 counters with the light source 1, and is arranged, and incidence of the light emitted from the light source 1 is carried out into a transparent material 3 from the optical plane of incidence 21. In this invention, the light source may be arranged to the optical plane of incidence 21 and other side edge sides of the side edge side 22 grade which counters, for example.
[0012] Two principal planes which carried out the abbreviation rectangular cross have countered mutually the optical plane of incidence 21 of a transparent material 3, it is located in XY side and parallel, respectively, and one of fields turns into the optical outgoing radiation side 23. When the lens train of a split face or a large number gives directive light outgoing radiation functions, such as the optical outgoing radiation side 21 and a lens side formed at abbreviation parallel, to one [at least] field of this optical outgoing radiation side 23 or its rear face 24, outgoing radiation of the light which has directivity from the optical outgoing radiation side 23 is carried out.
[0013] As for the split face formed in the front face of a transparent material 3, or a lens train, it is desirable to consider as the range whose average tilt-angle thetaa is 0.5-7.5 degrees from the point of planning regularity of the brightness in the optical outgoing radiation side 23. This average tilt-angle thetaa is in the inclination for the rate alpha of outgoing radiation to become large, when there are the rate alpha of outgoing radiation and relation of a transparent material 3 and average tilt-angle thetaa

becomes large. For this reason, when average tilt-angle thetaa becomes smaller than 0.5, it is in the inclination for the rate alpha of outgoing radiation of a transparent material 3 to become small, for the amount of outgoing radiation of the light which carries out outgoing radiation from a transparent material 3 to decrease, and for brightness to become low. Moreover, if average tilt-angle thetaa takes 7.5 degrees and becomes large, the rate alpha of outgoing radiation of a transparent material 3 will become large, and a great portion of light will carry out outgoing radiation in the field near the light source 1 of the optical outgoing radiation side 23. It decreases suddenly as it separates from the light source 1, and it is in the inclination for attenuation of the light which spreads a transparent material 3 to become large and the outgoing radiation light from the optical outgoing radiation side 23 also separates from the light source 1, and it is in the inclination for the regularity of the brightness in the optical outgoing radiation side 23 to fall. The range of average tilt-angle thetaa is 1-5 degrees still more preferably, and the range of it is 1.5-4 degrees more preferably.

[0014] According to -1984, a split-face configuration is measured using a sensing-pin type surface roughness meter, and average tilt-angle thetaa of the split face formed in a transparent material 3 can search for it using ISO4287 / following 1the (1) type, and (2) types from obtained inclination function f (x), being able to use the coordinate of the measurement direction as x. Here, L is measurement die length and deltaa is the tangent of average tilt-angle thetaa.

[0015]

[Equation 1]

[Equation 2]

Moreover, in order to control the directivity in a field (YZ side) parallel to the light source 1 of the outgoing radiation light from a transparent material 3 to other principal planes to which the directive light outgoing radiation function is not given, it is desirable to form the lens side which arranged the lens train of a large number prolonged to an abbreviation perpendicular direction (the direction of X) to the optical plane of incidence 21. In the operation gestalt shown in drawing 1 , a split face is formed in the optical outgoing radiation side 23, and the lens side which arranged in parallel the lens train of a large number prolonged to an abbreviation perpendicular direction (the direction of X) to the optical plane of incidence 21 is formed in a rear face 24. In this invention, conversely, the gestalt shown in drawing 1 may make the optical outgoing radiation side 23 a lens side, and may make a rear face 24 a split face.

[0016] What is in the range the rate of optical outgoing radiation of whose is 0.5 - 5% as such a transparent material 3 is desirable, and is 1 - 3% of range more preferably. It is because it is in the inclination for attenuation of light [in / if it is in the inclination for the quantity of light which will carry out outgoing radiation from a transparent material 3 if the rate of optical outgoing radiation becomes small / this / 0.5% to decrease, and for sufficient brightness to no longer be obtained and the rate of optical outgoing radiation becomes large 5%, a lot of light at the about one light source will carry out outgoing radiation, and / the direction of X in the optical outgoing radiation side 23] to become remarkable, and for the regularity of the brightness in the optical outgoing radiation side 23 to fall. Thus, by making the rate of optical outgoing radiation of a transparent material 3 into 0.5 - 5%, the include angle of the peak light which carries out outgoing radiation from an optical outgoing radiation side is in the range of 50-80 degrees to the normal of an optical outgoing radiation side, the luminous-intensity half-value width in a field perpendicular to the both sides of optical plane of incidence and an optical outgoing radiation side is 10-40 degrees, and outgoing radiation of the outgoing radiation light [as / whose luminous-intensity half-value width in a field perpendicular to said **** is 35-65 degrees] can be carried out including said peak light. In this invention, by carrying out outgoing radiation of the light of such a directive high outgoing radiation property from a transparent material 3, the direction of outgoing radiation can be efficiently deflected with the optical deflection component 4, and the surface

light source component which has high brightness can be offered.
[0017] In this invention, the rate of optical outgoing radiation from a transparent material 3 is defined as follows. If the relation with the outgoing radiation light reinforcement (I) in the location of distance L sets thickness (Z direction dimension) of a transparent material 3 to t from the optical reinforcement (I0) of the outgoing radiation light in the edge by the side of the optical plane of incidence 21 of the optical outgoing radiation side 23, and the edge by the side of the optical plane of incidence 21, relation like the following (3) types will be satisfied.
[0018]
[Equation 3]

Here, a constant alpha is a rate of optical outgoing radiation, and it is the rate (%) in which light carries out outgoing radiation from the transparent material 3 of per unit length (die length equivalent to transparent material thickness t) in the direction of X which intersects perpendicularly with the optical plane of incidence 21 in the optical outgoing radiation side 23. An axis of ordinate can be asked for this rate alpha of optical outgoing radiation from that inclination in plotting (L/t) from the optical outgoing radiation side 23 to the logarithm and axis of abscissa of optical reinforcement of outgoing radiation light. The rate alpha of optical outgoing radiation has the magnitude of the irregularity of a split face, a configuration, and a close relation. however, as shown in drawing 1 , when a lens train is formed in a rear face 24 In order that it may be bent when the travelling direction of the light in a transparent material 3 carries out incidence to a lens side, or incidence is carried out by the incident angle of under a critical angle to a lens side, outgoing radiation is carried out out of a transparent material 3, and light may reflect with the reflective component 5 and may carry out incidence again, It does not necessarily depend for this rate alpha of optical outgoing radiation only on the condition of the split face of the optical outgoing radiation side 23.
[0019] Although the prism train prolonged in the direction of abbreviation X as the lens train, a lenticular lens train, a V character-like slot, etc. are mentioned when forming a lens train in the rear face 24 or the optical outgoing radiation side 23 of a transparent material 3 as shown in drawing 1 , it is desirable that the configuration of the cross section of the YZ direction considers as an abbreviation triangle-like prism train. The directivity in a field (for example, YZ side) parallel to the light source 1 of the outgoing radiation light from a transparent material 3 is controllable by refraction or reflex action of this lens train. That is, outgoing radiation light distribution of a direction parallel to the light source 1 can be made **** by setting up the configuration of a lens train suitably.
[0020] In this invention, when forming a prism train as a lens train formed in a transparent material 3, it is desirable to make the vertical angle into the range of 70-150 degrees. this is enough in the outgoing radiation light from a transparent material 3 by making a vertical angle into this range -- collection Hikari -- it is because last thing is made and sufficient improvement in the brightness as a surface light source component can be aimed at. That is, by making a prism vertical angle into within the limits of this, in the field (for example, YZ side) containing the main outgoing radiation light parallel to the light source 1, outgoing radiation of the condensed outgoing radiation light whose luminous-intensity half-value width is 35-65 degrees can be carried out, and the brightness as a surface light source component can be raised. In addition, when forming a prism train in the optical outgoing radiation side 23, as for a vertical angle, it is desirable to consider as the range of 80-100 degrees, and when forming a prism train in a rear face 24, it is desirable [a vertical angle] to consider as the range of 70-80 degrees or 100-150 degrees.
[0021] With the operation gestalt shown in drawing 1 , the optical outgoing radiation side 23 consists of a split face, and a rear face 24 consists of fields which two or more prism trains of the shape of a cross-section abbreviation triangle prolonged to an abbreviation perpendicular direction (the direction of X) to the optical plane of incidence 21 arranged. By being good also as a curved surface and making the crowning of the shape of that cross-section abbreviation triangle into a curved surface, this prism train can lessen generating of defects, such as a blemish at the time of an assemble of a back light, while making easy imprint nature to the transparent material at the time of manufacture.
[0022] In addition, what used together with this in this invention instead of giving an optical outgoing radiation function to the optical above outgoing radiation side 23 or its rear face 24, and carried out mixing distribution of the optical diffusibility particle inside the transparent material may be used. Moreover, as a transparent material 3, it is not limited to a configuration as shown in drawing 1 , and

the thing of various configurations, such as the shape of the shape of tabular and a wedge and a model of a ship, can be used.

[0023] The optical deflection component 4 is arranged on the optical outgoing radiation side 23 of a transparent material 3. Two principal planes 41 and 42 of the optical deflection component 4 have countered mutually, and are located in XY side and parallel as a whole, respectively. On the other hand (principal plane located in the optical outgoing radiation side 23 side of a transparent material), inside [it is principal planes 41 and 42] is used as the light entering surface 41, and let another side be a light exiting surface 42. In this light entering surface 41 and light exiting surface 42, many cross-section abbreviation triangle-like prism trains are arranged, respectively, and that prism train is arranged so that the include angle with the optical plane of incidence 21 of a transparent material 3 to make may become 15 degrees or less, and it may become 5 degrees or less preferably, and it may become the optical plane of incidence 21 and abbreviation parallel still more preferably.

[0024] The optical deflection component 4 has the Mitsuyuki line writing direction conversion function and the function condensing [optical], and the prism train by which the prism train formed in the optical deflection component light entering surface 41 was formed in the optical deflection component light exiting surface 42 in the Mitsuyuki line writing direction conversion function mainly achieves a function condensing [optical].

[0025] The optical path of the beam of light in the optical deflection component 4 by which the prism train was formed in the light entering surface 41 of the optical deflection component 4 at drawing 2 was shown. In respect of the prism of a prism train, internal reflection of the light which carried out incidence aslant to the direction of a surface light source component normal (Z direction) at the optical deflection component 4 is carried out by total reflection operation, and it is bent in the direction of a surface light source component normal (Z direction) according to it. Thus, since a travelling direction is changed into incident light according to a total reflection operation of a prism train, outgoing radiation of the light of the outgoing radiation light intensity distribution corresponding to the outgoing radiation luminous-intensity distribution from a transparent material 3 can be carried out. Therefore, the light of the distribution rationalized by the transparent material 3 can be made to turn to in the direction of the purpose efficiently.

[0026] If the prism vertical angle of the prism train formed in a light entering surface 41 is 50-80 degrees and is this include-angle within the limits, it can make the direction of incident light change efficiently outgoing radiation light with the directivity from a transparent material 3 in the direction of the purpose according to a total reflection operation. The range of a prism vertical angle is 55 degrees - 75 degrees preferably, and the range of it is 60 degrees - 70 degrees still more preferably.

[0027] In this invention, the prism train formed in the light entering surface 41 of the optical deflection component 4 can also use what is not limited to a cross-section triangle-like prism train if the Mitsuyuki line writing direction translator which changes the outgoing radiation light from a transparent material 3 in the direction of the purpose (for example, the direction of a surface light source component normal) can be attained, and made the crowning and trough of a prism train the curve, the thing which made the prism side the curved surface.

[0028] The optical path of the beam of light in the optical deflection component 4 by which the prism train was formed in the light exiting surface 42 of the optical deflection component 4 at drawing 3 is shown. The light which had the travelling direction of light changed by the prism train of the Mitsuyuki line writing direction conversion device which is the 1st device of the optical deflection component 4 is condensed in the prism train of the condensing device which is the 2nd device. It is condensed by making the travelling direction of light change in the direction of a normal of the optical outgoing radiation side 23 of a transparent material 3 (Z direction) according to a refraction operation of the prism side of a prism train. Thus, since it is condensed by refraction operation of a prism train, the light of narrow distribution can be made to be fully able to collimate and it can be efficiently made suitable in the direction of the purpose.

[0029] The prism vertical angle of the prism train formed in the light exiting surface 42 of the optical deflection component 4 is 140-170 degrees, and the range of it is 150 degrees - 160 degrees preferably. When it becomes an acute angle from 140 degrees, it is in the inclination which the return light by the total reflection in prism **** arises, and causes the fall of the brightness of a surface light source component, and when a prism vertical angle is larger than 170 degrees, the condensing operation by refraction becomes small and it is in the inclination for the fully collimated outgoing radiation light to no longer be obtained.

[0030] In this invention, the prism train formed in the light exiting surface 42 of the optical deflection component 4 can also use what is not limited to a cross-section triangle-like prism train if the function

condensing [optical] which can condense distribution of the outgoing radiation light from a transparent material 3 to the target distribution can be attained, and made the crowning and trough of a prism train the curve, the thing which made the prism side the curved surface.
[0031] The optical deflection component 4 of this invention can attain the above-mentioned Mitsuyuki line writing direction conversion function and a function condensing [optical] with sufficient balance by constituting so that the prism train formed in the light entering surface 41 and the prism train formed in the light exiting surface 42 may serve as abbreviation parallel. Under the present circumstances, the pitch of both prism trains is almost the same, and it is 10% or less of range to constitute so that gap of the location of a prism train where the ridgeline of the prism train which counters location [a ridgeline] namely, counters may become within the limits of 20% or less of the pitch of a prism train desirable still more preferably, and it constitutes so that the location of the ridgeline of the prism train which counters more preferably may be mostly in agreement. By condensing the light into which the Mitsuyuki line writing direction was changed in one certain prism train as it is in the prism train countered in the same pitch, this is because the use effectiveness of light becomes high, and is because it is in the inclination to become the distribution which many peaks discover by luminous-intensity distribution of outgoing radiation light if gap of the location of this ridgeline exceeds 20%, and for the use effectiveness of light to fall.
[0032] Moreover, the smaller one of the distance of the prism train of the Mitsuyuki line writing direction translator formed in the light entering surface 41 of the optical deflection component 4 and the prism train of the condensing device formed in the light exiting surface 42 is good. This is because it is in the inclination to become the distribution which the light into which the Mitsuyuki line writing direction was changed in one certain prism train is no longer condensed as it is in the prism train countered in the same pitch, and many peaks discover by luminous-intensity distribution of outgoing radiation light, and for the use effectiveness of light to fall, when this distance becomes large. It is 2 double less or equal that the distance of the valley where both prism trains counter considers as 3 or less times of the pitch of a prism train desirable still more preferably, and the distance of both prism trains is a pitch and below equivalent more preferably.
[0033] The optical deflection component 4 of this invention the prism sheet in which many prism trains which become the prism sheet in which many prism trains which become a light entering surface side were formed to one field, and a light exiting surface side were formed to one field Can also use it, joining to one or making it pile each other up with another object, and so that each prism train array side may serve as an outside The prism sheet of one sheet which formed in both sides of a transparence base material many prism trains which become many prism trains which become a plane-of-incidence side, and an outgoing radiation side side, respectively can also be used. What the prism train was formed in latter both sides from a viewpoint of the use effectiveness of light [like], and was united with the above is desirable.
[0034] The light source 1 is the linear light source which extends in the direction of Y, and can use a fluorescent lamp and a cold cathode tube as this light source 1. The light source reflector 2 leads a loss to a transparent material 3 for the light of the light source 1 few. As the quality of the material, the plastic film which carries out metal vacuum evaporationo ******** can be used for a front face, for example. The light source reflector 2 is twisted through the external surface of the light source 1 to the light exiting surface edge section of the optical deflection component 4 from the edge section external surface of the light reflex component 5 as illustrated. On the other hand, the optical deflection component 4 is avoided and the light source reflector 2 can also be twisted from the edge section external surface of the light reflex component 5 to the optical outgoing radiation side edge section of a transparent material 3 through the external surface of the light source 1.
[0035] ****** which gives the same reflective member as such a light source reflector 2 to side edge sides other than side edge side 21 of a transparent material 3 is also possible. As a light reflex component 5, the sheet plastic which has a metal vacuum evaporationo reflecting layer can be used for a front face, for example. In this invention, it is also possible to replace with a reflective sheet as a light reflex component 5, and to consider as the light reflex layer formed in the rear face of a transparent material 3 of metal vacuum evaporationo etc.
[0036] The transparent material 3 and the optical deflection component 4 of this invention can consist of synthetic resin with high light transmittance. As such synthetic resin, methacrylic resin, acrylic resin, polycarbonate system resin, polyester system resin, and vinyl chloride system resin can be illustrated. Especially, methacrylic resin is excellent in the height of light transmittance, thermal resistance, kinetic property, and fabrication nature, and the optimal. As such methacrylic resin, it is resin which uses a methyl methacrylate as a principal component, and that whose methyl methacrylate is 80 % of the

weight or more is desirable. It may face forming surface structures, such as a surface structure of the split face of a transparent material 3 and the optical polarizing element 4, and a prism train, you may form by carrying out a heat press using the mold member which has the surface structure of a request of a lucite plate, and configuration grant may be carried out with screen-stencil, extrusion molding, injection molding, etc. at shaping and coincidence. Moreover, a structure side can also be formed using heat or a photo-setting resin. Furthermore, the split-face structure and lens train array structure which consist of activity energy-line hardening mold resin may be formed on a front face on transparence base materials, such as a bright film which consists of polyester system resin, acrylic resin, polycarbonate system resin, vinyl chloride system resin, poly methacrylic imide system resin, etc., or a sheet, and the junction unification of such a sheet may be carried out on a separate transparence base material by approaches, such as adhesion and welding. As activity energy-line hardening mold resin, the metal salt of a polyfunctional (meta) acrylic compound, a vinyl compound, acrylic ester (meta), an allyl compound, and an acrylic acid (meta) etc. can be used.

[0037] A liquid crystal display is constituted by arranging a liquid crystal display component on the luminescence side (light exiting surface of the optical polarizing element 4) of the surface light source component which consists of the above light sources 1, the light source reflector 2, a transparent material 3, an optical deflection component 4, and a light reflex component 5. A liquid crystal display is observed by the observer through a liquid crystal display component from the upper part in drawing 1 . Moreover, in this invention, since incidence of the light of the fully collimated narrow distribution can be carried out to a liquid crystal display component from a surface light source component, there is no tone reversal in a liquid crystal display component etc., and although an image with uniform brightness and hue is obtained, an angle of visibility will become narrow. Then, by laying diffusion members, such as an optical diffusion sheet and a lens sheet, in the observation side side of a liquid crystal display component, there is no tone reversal etc. and brightness and a hue can offer a liquid crystal display with a large angle of visibility uniformly.

[0038]

[Example] Hereafter, an example explains this invention concretely. In addition, measurement of each physical properties in the following examples was performed as follows.

[0039] Using a cold cathode tube as the brightness of a surface light source component, and a source of a measuring beam of luminous-intensity half-value width, DC12V were impressed to the inverter (Harrison HIU-742A), and RF lighting was carried out. Brightness divided the surface light source component or the front face of a transparent material into 3x5 at the square of 20mm around, and asked for the 15-point average of the brightness value of the direction of a normal of each square. Luminous-intensity half-value width fixed the black paper which has the pinhole of 4mmphi on a surface light source component or the front face of a transparent material so that a pinhole might be located in the surface center, it adjusted distance so that the measurement circle of a luminance meter might be set to 8-9mm, it was perpendicular and as parallel as the longitudinal direction shaft of a cold cathode tube, and it adjusted it so that a GONIO revolving shaft might rotate centering on a pinhole. Rotating a revolving shaft at intervals of 0.5 degrees to +80 degrees - -80 degrees in each direction, luminous-intensity distribution of outgoing radiation light was measured with the luminance meter, and it asked for the half-value width (angle of divergence of one half of distribution of peak value) of luminous-intensity distribution.

[0040] According to the measurement ISO 4287 of an average tilt angle (thetaa) / 1-1987, the surface roughness of a split face was measured by 0.03mm/second in drive rate with the sensing-pin type surface roughness plan (surfboard COM 570made from Tokyo Precision equipment A) using 010-2528 (1micromR, 55-degree cone, diamond) as a sensing pin. From the chart obtained by this measurement, that average line was deducted, the inclination was amended, and it calculated and asked by said formula (1) type and (2) types.

[0041] light -- outgoing radiation -- a rate (alpha) -- measurement -- a transparent material -- a lamp -- installing -- the side -- countering -- the side -- black -- an acrylic -- a sheet -- pasting up -- the reflected light -- having removed -- a condition -- carrying out -- a transparent material -- light -- outgoing radiation -- a field -- a center section -- the light source -- a side -- from -- the other end -- a field -- a side -- resulting -- 20 -- mm -- spacing -- having classified -- each -- a field -- brightness -- measured value -- from -- the above -- (-- three --) -- a formula -- being based -- having computed .

[0042] One field produced the light guide plate which is a mat (average tilt angle of 3.1 degrees) by carrying out injection molding using example 1 acrylic resin (AKURI pet VH 5#000 by Mitsubishi Rayon Co., Ltd.). This light guide plate was making the wedge tabular of 195mmx253mm and 3mm thickness to 1 mm. 140 degrees of prism vertical angles of a prism train and the prism layer in which the pitch

50micrometer prism train carried out the successive formation array at juxtaposition were formed with acrylic ultraviolet-rays hardening resin so that it might become parallel to the side (shorter side) with a die length [of a transparent material] of 195mm at the mirror plane side of this transparent material. While [corresponding to the side (long side) with a die length / of a transparent material / of 253mm] has covered and arranged the cold cathode tube along a long side with the light source reflector (silver [by REIKO Co., Ltd.] reflective film), as the side edge side was countered. Furthermore, the optical diffuse reflection film (Toray Industries, Inc. make E60) was stuck on other side edge sides, and the reflective sheet has been arranged in the prism train array (rear face). The above configuration was included in the frame. The maximum peak of outgoing radiation light luminous-intensity distribution of this transparent material was [27 degrees and the rate of optical outgoing radiation of 70 degrees and luminous-intensity half-value width] 1.7%.

[0043] The array side where acrylic ultraviolet-rays hardenability resin was used for polyester film with a thickness of 50 micrometers, and 63 degrees of prism vertical angles and the prism trains of pitch 50micrometer a large number were formed successively by juxtaposition on the other hand to one field in the field of another side by pitch 50micrometer (a) The array side where the prism trains of a large number which have each prism vertical angle of 150 degrees of vertical angles, 160 degrees of (b) vertical angles, and 170 degrees of (c) vertical angles were formed successively by juxtaposition is formed. The crest, the crest, trough, and trough of a prism train where both sides counter were in agreement, and three prism sheets formed so that the ridgeline might become parallel were produced. Spacing of the trough of a prism train and trough where both sides counter was about 60 micrometers.

[0044] The prism train array side of 63 degrees of prism vertical angles turned [sheet / each / which was obtained / prism] to the optical outgoing radiation side side of the above-mentioned transparent material, and it was laid so that the ridgeline of a prism train might become parallel at the optical plane of incidence of a transparent material. The normal brightness and the cold cathode tube of three surface light source components which were produced as mentioned above were asked for distribution of the luminous intensity in a perpendicular direction and a horizontal field, and the result was shown in Table 1. Moreover, outgoing radiation light distribution of the surface light source component at the time of using the prism sheet (b) of 160 degrees of prism vertical angles was shown in drawing 4 .

[0045] The prism sheet which formed in one field of polyester film with an example of comparison 1 thickness of 50 micrometers 63 degrees of prism vertical angles and the prism layer which formed successively the prism trains of pitch 50micrometer a large number to juxtaposition using acrylic ultraviolet-rays hardenability resin was produced. The prism train array side of 63 degrees of prism vertical angles turned [sheet / this / prism] to the optical outgoing radiation side side of the transparent material obtained in the example 1, and it was laid so that a prism ridgeline might become parallel at the optical plane of incidence of a transparent material. The normal brightness and the cold cathode tube of a surface light source component which were produced as mentioned above were asked for distribution of the luminous intensity in a perpendicular direction and a horizontal field, and the result was shown in Table 1.

[0046] Acrylic ultraviolet-rays hardenability resin is used for polyester film with an example of comparison 2 thickness of 50 micrometers. The array side where 63 degrees of prism vertical angles and the prism trains of pitch 50micrometer a large number were formed successively by juxtaposition to one field The array side where 140 degrees of prism vertical angles and the prism trains of pitch 50micrometer a large number were formed successively by juxtaposition was formed in the field of another side, the crest, the crest, trough, and trough of a prism train where both sides counter were in agreement, and the prism sheet formed so that the ridgeline might become parallel was produced. Spacing of the trough of a prism train and trough where both sides counter was about 60 micrometers. The prism train array side of 63 degrees of vertical angles turned [sheet / which was obtained / prism] to the optical outgoing radiation side side of the transparent material obtained in the example 1, and it was laid so that the ridgeline of a prism train might become parallel at the optical plane of incidence of a transparent material. The normal brightness and the cold cathode tube of a surface light source component which were produced as mentioned above were asked for distribution of the luminous intensity in a perpendicular direction and a horizontal field, and the result was shown in Table 1.

[0047]

[Table 1]

[0048]
[Effect of the Invention] In this invention, the ridgelines of the prism train by the side of a light entering surface and a light exiting surface are abbreviation parallel mutually, and when an ON light side is 50-80 degrees and a light exiting surface side uses the optical deflection component (prism sheet) which is 140-170 degrees, distribution of outgoing radiation light is very narrow, and the prism vertical angle of a prism train is controlled, and can offer the prism sheet used for the surface light source component and it which have ** and high brightness that tone reversal in a liquid crystal device cannot happen easily.

[Brief Description of the Drawings]
[Drawing 1] It is the typical decomposition perspective view showing 1 operation gestalt of the surface light source component of this invention.
[Drawing 2] It is the optical-path Fig. showing an operation of the prism train by the side of the light entering surface of the optical deflection component of this invention.
[Drawing 3] It is the optical-path Fig. showing an operation of the prism train by the side of the light exiting surface of the optical deflection component of this invention.
[Drawing 4] It is outgoing radiation light distribution of the surface light source component of the example 1 of this invention.
[Description of Notations]
1 Light Source
2 Light Source Reflector
3 Transparent Material
4 Optical Deflection Component
5 Reflective Component
6 Shielding Material
21 Optical Plane of Incidence
22 Optical Incidence Opposed Face
23 Optical Outgoing Radiation Side
24 Rear Face
41 Light Entering Surface
42 Light Exiting Surface

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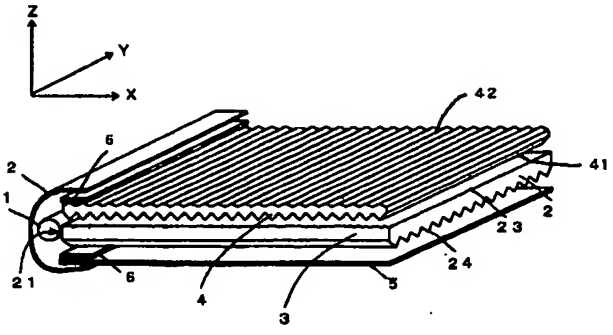
(54)【発明の名称】　プリズムシートおよび面光源素子

(57)【要約】　（修正有）
【課題】　出射光の分布が非常に狭くコントロールされ液晶素子での階調反転が起こり難くく、輝度の高い面光源素子およびそれに使用するプリズムシートを提供する。
【解決手段】　入光面４１側と出光面４２側に断面略三角形状の多数のプリズム列が並列に配列されたプリズム列配列面を有しており、入光面側と出光面側のプリズム列の稜線が互いに略平行で、入光面側のプリズム列の頂角が５０～８０°で、出光面側のプリズム列の頂角が１４０～１７０°である光偏向素子４を、プリズム列が導光体３の光入射面２１と略平行になるように導光体３の光出射面２３上に配置した面光源素子。



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【特許請求の範囲】

【請求項１】　光源と、該光源に対向する少なくとも１つの光入射面およびこれと略直交する光出射面を有し、光源から入射する光を光出射面から出射させる光出射機構を有する導光体と、導光体の光出射面上に配置された光偏向素子と、導光体の光出射面に対向する裏面に配置された光反射素子とからなり、前記光偏向素子が、その入光面側と出光面側に断面略三角形状の多数のプリズム列が並列に配列されたプリズム列配列面を有しており、入光面側と出光面側のプリズム列の稜線が互いに略平行で、入光面側のプリズム列の頂角が５０～８０°で、出光面側のプリズム列の頂角が１４０～１７０°であり、プリズム列が導光体の光入射面と略平行になるように配置されていることを特徴とする面光源素子。

【請求項２】　前記導光体から出射する出射光の分布が、光入射面と光出射面との双方に垂直な面において、ピーク光の角度が光出射面の法線に対し５０～８０°で、光度半値幅が１０～４０°であることを特徴とする請求項１記載の面光源素子。

【請求項３】　前記導光体の光出射面およびその裏面の少なくとも一方の面に、粗面あるいは多数のレンズ列が光出射面と略平行に形成されたレンズ面が形成されていることを特徴とする請求項１、２のいずれかに記載の面光源素子。

【請求項４】　前記導光体の光出射面およびその裏面の少なくとも一方の面に、光入射面に対して略垂直に延びる多数のレンズ列が形成されていることを特徴とする請求項１～３のいずれかに記載の面光源素子。

【請求項５】　前記導光体に形成された多数のレンズ列が、断面略三角形状で頂角６０～１５０°のプリズム列であることを特徴とする請求項４記載の面光源素子。

【請求項６】　前記光偏向素子の入光面側と出光面側のプリズム列のピッチが略同一であり、対向するプリズム列の稜線の位置がプリズム列のピッチの２０％以下の範囲にあることを特徴とする請求項１～５のいずれかに記載の面光源素子。

【請求項７】　対向するプリズム列の稜線の位置がほぼ一致していることを特徴とする請求項６記載の面光源素子。

【請求項８】　前記光偏向素子は、入光面側のプリズム列と出光面側のプリズム列との対向する谷間の距離がプリズム列のピッチの３倍以下であることを特徴とする請求項１～７のいずれかに記載の面光源素子。

【請求項９】　前記光偏向素子は、透明基材の両面にそれぞれ入光面側と出光面側のプリズム列が形成された１枚のシート状物からなることを特徴とする請求項１～８のいずれかに記載の面光源素子。

【請求項１０】　透明基材の一方の表面に頂角５０～８０°の断面略三角形状の複数のプリズム列が形成され、

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数のプリズム列が形成されており、両方の面に形成されたプリズム列の稜線が互いに略平行であることを特徴とするプリズムシート。

【請求項１１】　前記両面に形成されたプリズム列のピッチが略同一であり、対向するプリズム列の稜線の位置がプリズム列のピッチの２０％以下の範囲にあることを特徴とする請求項１０記載のプリズムシート。

【請求項１２】　対向するプリズム列の稜線の位置がほぼ一致するように配置されていることを特徴とする請求項１１記載のプリズムシート。

【請求項１３】　一方の表面に形成されたプリズム列と他方の面に形成されたプリズム列との対向する谷間の距離がプリズム列のピッチの３倍以下であることを特徴とする請求項９～１２のいずれかに記載のプリズムシート。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、ノートパソコン、液晶テレビ等の液晶表示装置に使用されるエッジライト方式の面光源素子およびそれに使用されるプリズムシートに関するものであり、さらに詳しくは、出射光の分布が非常に狭くコントロールされ、高い輝度を有する面光源素子およびそれに用いるプリズムシートに関するものである。

【０００２】

【従来の技術】近年、カラー液晶表示装置は、携帯用ノートパソコン、パソコン等のモニター、カラー液晶パネルを用いた液晶テレビあるいはビデオ一体型液晶テレビ等の種々の分野で広く使用されてきている。また、情報処理量の増大化、ニーズの多様化、マルチメディア対応等に伴って、液晶表示装置の大画面化、高精細化が盛んに進められている。

【０００３】液晶表示装置は、基本的にバックライト部と液晶表示素子部とから構成されている。バックライト部としては、液晶表示素子部の直下に光源を配置した直下方式のものや導光体の側端面に対向するように光源を配置したエッジライト方式のものがあり、液晶表示装置のコンパクト化の観点からエッジライト方式が多用されている。

【０００４】このようなバックライトを使用した液晶表示装置の場合、液晶セル内での液晶分子が９０°または更に大きな角度で捻れており、セル内に入射した直線偏光光の偏光軸を回転させ、セルの出射側に配置された偏光素子の偏光軸の方向によって光の透過または遮断を行い、画面の表示がなされる。しかしながら、通常のバックライトから液晶セル内に入射する光は入射角に分布が存在するため、分布の角度によってそれぞれの光はセル内の液晶の捻れから受ける回転の度合いが異なって、偏光素子を通過する際の透過または遮断の度合いが入射光

の画面を見る方向によって、明るさ、色相が異なることになり、液晶表示装置で特有の階調反転という現象が生じる。

【０００５】

【発明が解決しようとする課題】このような明るさ、色相の不均一さ改善するため種々の方法が提案されている。例えば、１つの液晶セル内部を２つ以上のドメインに分割し、分割したセル内部の液晶分子の捻れを左右の光の角度分布に対し調整する方法、１つの液晶セル内で液晶分子の捻れを配向方向を放射状にするもの、駆動電極を液晶セル基盤に平行に配置し液晶分子を平行に配向させるもの、位相差板の屈折率軸を傾けて位相のズレを補償する方法等がある。

【０００６】しかしながら、これらの方法では複雑な特殊構造の液晶セルを使用したり、特殊な方向に液晶分子を配向させたり、特殊な位相差板を用いる必要があり、液晶表示装置の生産性に劣るとともに、高価な特殊部材を用いなければならないという問題点を有していた。

【０００７】そこで、本発明の目的は、出射光の分布が非常に狭くコントロールされ液晶表示装置の階調反転を起こし難くするとともに、高い輝度を有する面光源素子およびそれに使用するプリズムシートを提供することにある。

【０００８】

【課題を解決させるための手段】本発明者等は、このような状況に鑑み、液晶セルに分布の非常に狭いコリメート光を入射させ、液晶セルから出射した出射光を拡散部材等で広げることによって、広い視野角を有し、かつ階調反転の生じにくい液晶表示装置を提供でき、特定構造の光偏向素子を用いることによって、非常に狭い分布のコリメート化され光を出射させることを見出し、本発明に到達したものである。

【０００９】すなわち、本発明の面光源素子は、光源と、該光源に対向する少なくとも１つの光入射面およびこれと略直交する光出射面を有し、光源から入射する光を光出射面から出射させる光出射機構を有する導光体と、導光体の光出射面上に配置された光偏向素子と、導光体の光出射面に対向する裏面に配置された光反射素子とからなり、前記光偏向素子が、その入光面側と出光面側に断面略三角形状の多数のプリズム列が並列に配列されたプリズム列配列面を有しており、入光面側と出光面側のプリズム列の稜線が互いに略平行で、入光面側のプリズム列の頂角が５０～８０°で、出光面側のプリズム列の頂角が１４０～１７０°であり、プリズム列が導光体の光入射面と略平行になるように配置されていることを特徴とするものである。また、本発明のプリズムシートは、透明基材の一方の表面に頂角５０～８０°の断面略三角形状の複数のプリズム列が形成され、他方の面に頂角１４０～１７０°の断面略三角形状の複数のプリズム列の稜線が互いに略平行であることを特徴とするものである。

【００１０】

【発明の実施の形態】以下、図面を参照にしながら、本発明の実施の形態を説明する。図１は、本発明の面光源素子の代表的な一つの実施形態を示すものである。図１に示されているように、本発明の面光源素子は、少なくとも一つの側端面を光入射面２１とし、これと略直交する一つの表面を光出射面２３とする導光体３と、この導光体３の光入射面２１に対向して配置され光源リフレクター２で覆われた光源１と、導光体３の光出射面上に配置された光偏向素子４と、導光体３の光出射面２３の裏面２４に配置された反射素子５とから構成される。なお、図中６は、ランプ際近傍の輝線や暗線を防止するための遮蔽材であり、必要に応じて設置することができる。

【００１１】導光体３は、ＸＹ面と平行に配置されており、全体として矩形状をなしている。導光体３は４つの側端面を有しており、そのうちＹＺ面と平行で互いに対向して配置されている１対の側端面のうちの少なくとも一つの側端面を光入射面２１とする。光入射面２１は光源１と対向して配置されており、光源１から発せられた光は光入射面２１から導光体３内へと入射する。本発明においては、例えば、光入射面２１と対向する側端面２２等の他の側端面にも光源を配置してもよい。

【００１２】導光体３の光入射面２１に略直交した２つの主面は互いに対向しており、それぞれＸＹ面と平行に位置し、いずれか一方の面が光出射面２３となる。この光出射面２３またはその裏面２４のうちの少なくとも一方の面に粗面や多数のレンズ列が光出射面２１と略平行に形成されたレンズ面等の指向性光出射機能を付与することによって、光出射面２３から指向性のある光を出射させる。

【００１３】導光体３の表面に形成する粗面やレンズ列は、平均傾斜角θａが０．５～７．５°の範囲とすることが、光出射面２３内での輝度の均斉度を図る点から好ましい。この平均傾斜角θａは、導光体３の出射率αと関連があり、平均傾斜角θａが大きくなると出射率αも大きくなる傾向にある。このため、平均傾斜角θａが０．５より小さくなると、導光体３の出射率αが小さくなり導光体３から出射する光の出射量が少なくなり輝度が低くなる傾向にある。また、平均傾斜角θａが７．５°とり大きくなると、導光体３の出射率αが大きくなり光出射面２３の光源１に近い領域で大部分の光が出射し、光源１から離れるに従い導光体３を伝搬する光の減衰が大きくなる傾向にあり、光出射面２３からの出射光も光源１から離れるに従って急に減衰し、光出射面２３内での輝度の均斉度が低下する傾向にある。平均傾斜角θａは、さらに好ましくは１～５°の範囲であり、より

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【００１４】導光体３に形成される粗面の平均傾斜角θａは、ＩＳＯ４２８７／１－１９８４に従って、触針式表面粗さ計を用いて粗面形状を測定し、測定方向の座標をｘとして、得られた傾斜関数ｆ（ｘ）から次の（１）式および（２）式を用いて求めることができる。ここ＊

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＊で、Ｌは測定長さであり、Δａは平均傾斜角θａの正接である。

【００１５】

【数１】

$$\Delta a = (1/L)\int_0^L |(d/dx) f(x)| dx \quad \cdots \quad (1)$$

【数２】

$$\theta a = \tan^{-1}(\Delta a) \quad \cdots \quad (2)$$

また、指向性光出射機能が付与されていない他の主面には、導光体３からの出射光の光源１と平行な面（ＹＺ面）での指向性を制御するために、光入射面２１に対して略垂直方向（Ｘ方向）に延びる多数のレンズ列を配列したレンズ面を形成することが好ましい。図１に示した実施形態においては、光出射面２３に粗面を形成し、裏面２４に光入射面２１に対して略垂直方向（Ｘ方向）に延びる多数のレンズ列を並列したレンズ面を形成している。本発明においては、図１に示した形態とは逆に、光出射面２３をレンズ面とし、裏面２４を粗面とするものであってもよい。

【００１６】このような導光体３としては、その光出射率が０．５～５％の範囲にあるものが好ましく、より好ましくは１～３％の範囲である。これは、光出射率が０．５％より小さくなると導光体３から出射する光量が少なくなり十分な輝度が得られなくなる傾向にあり、光出射率が５％より大きくなると光源１近傍で多量の光が出射して、光出射面２３内でのＸ方向における光の減衰※

※が著しくなり、光出射面２３での輝度の均斉度が低下する傾向にあるためである。このように導光体３の光出射率を０．５～５％とすることにより、光出射面から出射するピーク光の角度が光出射面の法線に対し５０～８０°の範囲にあり、光入射面と光出射面の双方に垂直な面における光度半値幅が１０～４０°であり、前記ピーク光を含み前記垂面と垂直な面における光度半値幅が３５～６５°であるような出射光を出射することができる。本発明においては、導光体３からこのような指向性の高い出射特性の光を出射させることにより、その出射方向を光偏向素子４で効率的に偏向させることができ、高い輝度を有する面光源素子を提供することができる。

【００１７】本発明において、導光体３からの光出射率は次のように定義される。光出射面２３の光入射面２１側の端縁での出射光の光強度（I_0）と光入射面２１側の端縁から距離Ｌの位置での出射光強度（Ｉ）との関係は、導光体３の厚さ（Ｚ方向寸法）をｔとすると、次の（３）式のような関係を満足する。

【００１８】

【数３】

$$I = I_0 \cdot \alpha \cdot (1-\alpha)^{L/t} \quad \cdots \quad (3)$$

ここで、定数αが光出射率であり、光出射面２３における光入射面２１と直交するＸ方向での単位長さ（導光体厚さｔに相当する長さ）当たりの導光体３から光が出射する割合（％）である。この光出射率αは、縦軸に光出射面２３からの出射光の光強度の対数と横軸に（Ｌ／ｔ）をプロットすることで、その勾配から求めることができる。光出射率αは、粗面の凹凸の大きさや形状と密接な関係にある。しかし、図１に示したように、裏面２４にレンズ列を形成したような場合には、導光体３内の光の進行方向がレンズ面に入射した際に曲げられたり、光がレンズ面に対して臨界角未満の入射角で入射して導光体３外へと出射し、反射素子５で反射して再び入射したりするため、この光出射率αは必ずしも光出射面２３の粗面の状態だけに依存するものではない。

【００１９】図１に示したように、導光体３の裏面２４あるいは光出射面２３にレンズ列を形成する場合、そのキュラーレンズ列、Ｖ字状溝等が挙げられるが、ＹＺ方向の断面の形状が略三角形状のプリズム列とすることが好ましい。このレンズ列の屈折または反射作用により、導光体３からの出射光の光源１と平行な面（例えばＹＺ面）での指向性を制御することができる。すなわち、レンズ列の形状を適宜設定することにより、光源１と平行な方向の出射光分布を所望なものとすることができる。

【００２０】本発明において、導光体３に形成されるレンズ列としてプリズム列を形成する場合には、その頂角を７０～１５０°の範囲とすることが好ましい。これは、頂角をこの範囲とすることによって導光体３からの出射光を十分集光させることができ、面光源素子としての輝度の十分な向上を図ることができるためである。すなわち、プリズム頂角をこの範囲内とすることによって、光源１に平行な主出射光を含む面（例えばＹＺ面）において光度半値幅が３５～６５°である集光された出射光

上させることができる。なお、プリズム列を光出射面２３に形成する場合には、頂角は８０～１００°の範囲とすることが好ましく、プリズム列を裏面２４に形成する場合には、頂角は７０～８０°または１００～１５０°の範囲とすることが好ましい。

【００２１】図１に示した実施形態では、光出射面２３は粗面からなり、裏面２４は光入射面２１に対して略垂直方向（Ｘ方向）に延びる断面略三角形状の複数のプリズム列が配列した面から構成される。このプリズム列は、その断面略三角形状の頂部を曲面としてもよく、曲面とすることによって、製造時の導光体への転写性を容易にするとともにバックライトのアセンブル時の傷等の欠陥の発生を少なくすることができる。

【００２２】なお、本発明では、上記のような光出射面２３またはその裏面２４に光出射機能を持たせる代わりにあるいはこれと併用して、導光体内部に光拡散性微粒子を混入分散したものでもよい。また、導光体３としては、図１に示したような形状に限定されるものではなく、板状、くさび状、船型状等の種々の形状のものが使用できる。

【００２３】光偏向素子４は、導光体３の光出射面２３上に配置されている。光偏向素子４の２つの主面４１、４２は互いに対向しており、それぞれ全体としてＸＹ面と平行に位置する。主面４１、４２のうちの一方（導光体の光出射面２３側に位置する主面）は入光面４１とされており、他方が出光面４２とされている。この入光面４１および出光面４２には、それぞれ断面略三角形状の多数のプリズム列が配列されており、そのプリズム列が導光体３の光入射面２１とのなす角度が１５°以下となるように、好ましくは５°以下となるように、さらに好ましくは光入射面２１と略平行となるように配置されている。

【００２４】光偏向素子４は、光進行方向転換機能と光集光機能を有しており、光偏向素子入光面４１に形成されたプリズム列が光進行方向転換機能を、光偏向素子出光面４２に形成されたプリズム列が光集光機能を主として果たす。

【００２５】図２に、光偏向素子４の入光面４１にプリズム列が形成された光偏向素子４における光線の光路を示した。面光源素子法線方向（Ｚ方向）に対して斜めに光偏向素子４に入射した光が、プリズム列のプリズム面で全反射作用によって内面反射され、面光源素子法線方向（Ｚ方向）に曲げられる。このように、入射光はプリズム列の全反射作用によって進行方向を変換されるので、導光体３からの出射光の強度分布に対応した出射光強度分布の光を出射させることができる。従って、導光体３によって適正化された分布の光を効率よく目的の方向へ向かせることができる。

【００２６】入光面４１に形成されるプリズム列のプリズム頂角は、導光体３からの指向性のある出射光を全反射作用により目的の方向に効率よく入射光の方向を変更させることができる。プリズム頂角は、好ましくは５５°～７５°の範囲であり、更に好ましくは６０°～７０°の範囲である。

【００２７】本発明においては、光偏向素子４の入光面４１に形成されるプリズム列は、導光体３からの出射光を目的の方向（例えば面光源素子法線方向）に変換する光進行方向変換機構を達成できるものであれば断面三角形状のプリズム列に限定されるものではなく、例えばプリズム列の頂部や谷部を曲線としたもの、プリズム面を曲面としたもの等を用いることも可能である。

【００２８】図３に、光偏向素子４の出光面４２にプリズム列が形成された光偏向素子４における光線の光路を示す。光偏向素子４の第１の機構である光進行方向転換機構のプリズム列によって光の進行方向を変更された光は、第２の機構である集光機構のプリズム列で集光される。プリズム列のプリズム面の屈折作用によって導光体３の光出射面２３の法線方向（Ｚ方向）に光の進行方向を変更させることで集光される。このように、プリズム列の屈折作用により集光されるので、狭い分布の光を十分にコリメートさせ効率よく目的の方向へ向かせることができる。

【００２９】光偏向素子４の出光面４２に形成されるプリズム列のプリズム頂角は１４０～１７０°であり、好ましくは１５０°～１６０°の範囲である。１４０°より鋭角になるとプリズム稜面での全反射による戻り光が生じ面光源素子の輝度の低下を招く傾向にあり、プリズム頂角が１７０°より大きいと屈折による集光作用が小さくなり、十分にコリメートされた出射光が得られなくなる傾向にある。

【００３０】本発明においては、光偏向素子４の出光面４２に形成されるプリズム列は、導光体３からの出射光の分布を目的の分布に集光できる光集光機能を達成できるものであれば断面三角形状のプリズム列に限定されるものではなく、例えばプリズム列の頂部や谷部を曲線としたもの、プリズム面を曲面としたもの等を用いることも可能である。

【００３１】本発明の光偏向素子４は、入光面４１に形成されたプリズム列と出光面４２に形成されたプリズム列が略平行となるように構成することにより、上記光進行方向転換機能と光集光機能をバランスよく達成することができる。この際、両方のプリズム列のピッチがほぼ同一で、対向するプリズム列の稜線の位置、すなわち対向するプリズム列の位置のズレがプリズム列のピッチの２０％以下の範囲内となるように構成することが好ましく、さらに好ましくは１０％以下の範囲であり、より好ましくは対向するプリズム列の稜線の位置がほぼ一致するように構成する。これは、ある一つのプリズム列で光

リズム列でそのまま集光されることにより、光の利用効率が高くなるためであり、この稜線の位置のズレが２０％を超えると出射光の光度分布で多数のピークが発現するような分布となり、光の利用効率が低下する傾向にあるためである。

【００３２】また、光偏向素子４の入光面４１に形成された光進行方向変換機構のプリズム列と、出光面４２に形成された集光機構のプリズム列との距離は小さい方がよい。これは、この距離が大きくなると、ある一つのプリズム列で光進行方向を変換された光が、同一ピッチ内の対向するプリズム列でそのまま集光されなくなり、出射光の光度分布で多数のピークが発現するような分布となり、光の利用効率が低下する傾向にあるためである。両方のプリズム列の距離は、両方のプリズム列の対向する谷間の距離が、プリズム列のピッチの３倍以下とすることが好ましく、さらに好ましくは２倍以下であり、より好ましくはピッチと同等以下である。

【００３３】本発明の光偏向素子４は、入光面側となる多数のプリズム列を一方の面に形成したプリズムシートと出光面側となる多数のプリズム列を一方の面に形成したプリズムシートとを、それぞれのプリズム列配列面が外側となるように、一体に接合してあるいは別体のまま重ね合わせて使用することもできるし、透明基材の両面に入射面側となる多数のプリズム列と出射面側となる多数のプリズム列をそれぞれ形成した一枚のプリズムシートを使用することもできる。上記にような光の利用効率の観点からは、後者の両面にプリズム列が形成され一体化されたものが好ましい。

【００３４】光源１はＹ方向に延在する線状の光源であり、該光源１としては例えば蛍光ランプや冷陰極管を用いることができる。光源リフレクタ２は光源１の光をロスを少なく導光体３へ導くものである。材質としては、例えば表面に金属蒸着反射層有するプラスチックフィルムを用いることができる。図示されているように、光源リフレクタ２は、光反射素子５の端縁部外面から光源１の外面を経て光偏向素子４の出光面端縁部へと巻きつけられている。他方、光源リフレクタ２は、光偏向素子４を避けて、光反射素子５の端縁部外面から光源１の外面を経て導光体３の光出射面端縁部へと巻きつけることも可能である。

【００３５】このような光源リフレクタ２と同様な反射部材を、導光体３の側端面２１以外の側端面に付することも可能である。光反射素子５としては、例えば表面に金属蒸着反射層を有するプラスチックシートを用いることができる。本発明においては、光反射素子５として反射シートに代えて、導光体３の裏面に金属蒸着等により形成された光反射層等とすることも可能である。

【００３６】本発明の導光体３及び光偏向素子４は、光透過率の高い合成樹脂から構成することができる。この脂、ポリカーボネート系樹脂、ポリエステル系樹脂、塩化ビニル系樹脂が例示できる。特に、メタクリル樹脂が、光透過率の高さ、耐熱性、力学的特性、成形加工性に優れており、最適である。このようなメタクリル樹脂としては、メタクリル酸メチルを主成分とする樹脂であり、メタクリル酸メチルが８０重量％以上であるものが好ましい。導光体３及び光偏光素子４の粗面の表面構造やプリズム列等の表面構造を形成するに際しては、透明合成樹脂板を所望の表面構造を有する型部材を用いて熱プレスすることで形成してもよいし、スクリーン印刷、押出成形や射出成形等によって成形と同時に形状付与してもよい。また、熱あるいは光硬化性樹脂等を用いて構造面を形成することもできる。更に、ポリエステル系樹脂、アクリル系樹脂、ポリカーボネート系樹脂、塩化ビニル系樹脂、ポリメタクリルイミド系樹脂等からなる透明フィルムあるいはシート等の透明基材上に、活性エネルギー線硬化型樹脂からなる粗面構造またレンズ列配列構造を表面に形成してもよいし、このようなシートを接着、融着等の方法によって別個の透明基材上に接合一体化させてもよい。活性エネルギー線硬化型樹脂としては、多官能（メタ）アクリル化合物、ビニル化合物、（メタ）アクリル酸エステル類、アリル化合物、（メタ）アクリル酸の金属塩等を使用することができる。

【００３７】以上のような光源１、光源リフレクタ２、導光体３、光偏向素子４および光反射素子５とからなる面光源素子の発光面（光偏光素子４の出光面）上に、液晶表示素子を配置することにより液晶表示装置が構成される。液晶表示装置は、図１における上方から液晶表示素子を通して観察者により観察される。また、本発明においては、十分にコリメートされた狭い分布の光を面光源素子から液晶表示素子に入射させることができるため、液晶表示素子での階調反転等がなく明るさ、色相が均一な画像が得られるものの視野角は狭いものとなる。そこで、液晶表示素子の観察面側に光拡散シート、レンズシート等の拡散部材を載置することによって、階調反転等がなく明るさ、色相が均一であり、かつ視野角の広い液晶表示装置を提供することができる。

【００３８】

【実施例】以下、実施例によって本発明を具体的に説明する。なお、以下の実施例における各物性の測定は下記のようにして行った。

【００３９】<u>面光源素子の輝度、光度半値幅の測定</u>

光源として、冷陰極管を用いインバータ（ハリソン社製ＨＩＵ－７４２Ａ）にＤＣ１２Ｖを印加して高周波点灯させた。輝度は、面光源素子あるいは導光体の表面を２０ｍｍ四方の正方形に３×５分割し、各正方形の法線方向の輝度値の１５点平均を求めた。光度半値幅は、面光源素子あるいは導光体の表面に４ｍｍφのピンホールを有する黒色の紙をピンホールが表面の中央に位置するよ

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距離を調整し、冷陰極管の長手方向軸と垂直方向および平行方向でピンホールを中心にゴニオ回転軸が回転するように調節した。それぞれの方向で回転軸を＋８０°～－８０°まで０．５°間隔で回転させながら、輝度計で出射光の光度分布を測定し、光度分布の半値幅（ピーク値の１／２の分布の広がり角）を求めた。

【００４０】平均傾斜角（θａ）の測定

ＩＳＯ４２８７／１－１９８７に従って、触針として０１０－２５２８（１μｍＲ、５５°円錐、ダイヤモンド）を用いた触針式表面粗さ計（東京精器（株）製サーフコム５７０Ａ）にて、粗面の表面粗さを駆動速度０．０３ｍｍ／秒で測定した。この測定により得られたチャートより、その平均線を差し引いて傾斜を補正し、前記式（１）式および（２）式によって計算して求めた。

【００４１】光出射率（α）の測定

導光体のランプを設置する辺に対向する辺に、黒色アクリルシートを接着して反射光を除去した状態にして、導光体の光出射面の中央部の光源側から他端面側に至る２０ｍｍ間隔で区分した各領域での輝度の測定値から、前記（３）式に基づいて算出した。

【００４２】実施例１

アクリル樹脂（三菱レイヨン（株）製アクリペットＶＨ５＃０００）を用い射出成形することによって一方の面がマット（平均傾斜角３．１°）である導光板を作製した。該導光板は、１９５ｍｍ×２５３ｍｍ、厚さ３ｍｍ－１ｍｍのクサビ板状をなしていた。この導光体の鏡面側に、導光体の長さ１９５ｍｍの辺（短辺）と平行になるように、アクリル系紫外線硬化樹脂によってプリズム列のプリズム頂角１４０°、ピッチ５０μｍのプリズム列が並列に連設配列したプリズム層を形成した。導光体の長さ２５３ｍｍの辺（長辺）に対応する一方の側端面に対向するようにして、長辺に沿って冷陰極管を光源リフレクター（麗光社製銀反射フィルム）で覆い配置した。さらに、その他の側端面に光拡散反射フィルム（東レ社製Ｅ６０）を貼付し、プリズム列配列（裏面）に反射シートを配置した。以上の構成を枠体に組み込んだ。この導光体の出射光光度分布の最大ピークは７０°、光度半値幅は２７°、光出射率は１．７％であった。

【００４３】一方、厚さ５０μｍのポリエステルフィルムにアクリル系紫外線硬化性樹脂を用いて、プリズム頂角６３°、ピッチ５０μｍの多数のプリズム列が並列に連設された配列面を一方の面に、他方の面にピッチ５０μｍで、（ａ）頂角１５０°、（ｂ）頂角１６０°、（ｃ）頂角１７０°のそれぞれのプリズム頂角を有する

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多数のプリズム列が並列に連設された配列面を形成し、両面の対向するプリズム列の山と山、谷と谷が一致し、その稜線が平行になるように形成した３つのプリズムシートを作製した。両面の対向するプリズム列の谷と谷との間隔は約６０μｍであった。

【００４４】得られたそれぞれのプリズムシートを、上記導光体の光出射面側にプリズム頂角６３°のプリズム列配列面が向き、導光体の光入射面にプリズム列の稜線が平行になるように載置した。以上のようにして作製された３つの面光源素子の、法線輝度と冷陰極管に垂直方向および水平方向の面内での光度の分布を求め、その結果を表１に示した。また、プリズム頂角１６０°のプリズムシート（ｂ）を使用した場合の面光源素子の出射光分布を図４に示した。

【００４５】比較例１

厚さ５０μｍのポリエステルフィルムの一方の面に、プリズム頂角６３°、ピッチ５０μｍの多数のプリズム列を並列に連設したプリズム層をアクリル系紫外線硬化性樹脂を用いて形成したプリズムシートを作製した。このプリズムシートを実施例１で得られた導光体の光出射面側にプリズム頂角６３°のプリズム列配列面が向き、導光体の光入射面にプリズム稜線が平行になるように載置した。以上のようにして作製された面光源素子の、法線輝度と冷陰極管に垂直方向および水平方向の面内での光度の分布を求め、その結果を表１に示した。

【００４６】比較例２

厚さ５０μｍのポリエステルフィルムにアクリル系紫外線硬化性樹脂を用いて、プリズム頂角６３°、ピッチ５０μｍの多数のプリズム列が並列に連設された配列面を一方の面に、他方の面にプリズム頂角１４０°、ピッチ５０μｍの多数のプリズム列が並列に連設された配列面を形成し、両面の対向するプリズム列の山と山、谷と谷が一致し、その稜線が平行になるように形成したプリズムシートを作製した。両面の対向するプリズム列の谷と谷との間隔は約６０μｍであった。得られたプリズムシートを実施例１で得られた導光体の光出射面側に頂角６３°のプリズム列配列面が向き、導光体の光入射面にプリズム列の稜線が平行になるように載置した。以上のようにして作製された面光源素子の、法線輝度と冷陰極管に垂直方向および水平方向の面内での光度の分布を求め、その結果を表１に示した。

【００４７】

【表１】

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		半値幅(°)		輝度
		垂直方向	水平方向	(cd/m^2)
実施例1	(a)	17	43	4100
	(b)	15	45	4250
	(c)	18	44	4070
比較例1		27	50	3600
比較例2		26	48	3700

【００４８】

【発明の効果】本発明においては、入光面側と出光面側のプリズム列の稜線が互いに略平行で且つプリズム列のプリズム頂角が入光側は５０～８０°であり、出光面側は１４０～１７０°である光偏向素子（プリズムシート）を使用することにより、出射光の分布が非常に狭くコントロールされ、液晶素子での階調反転が起こり難くく、高い輝度を有する面光源素子およびそれに使用するプリズムシートを提供できる。

【図面の簡単な説明】

【図１】本発明の面光源素子の一実施形態を示す模式的分解斜視図である。

【図２】本発明の光偏向素子の入光面側のプリズム列の作用を示す光路図である。

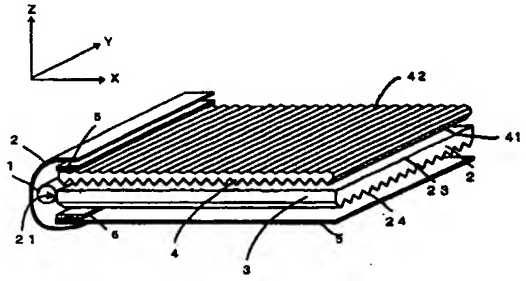
【図３】本発明の光偏向素子の出光面側のプリズム列の作用を示す光路図である。

【図４】本発明の実施例１の面光源素子の出射光分布である。

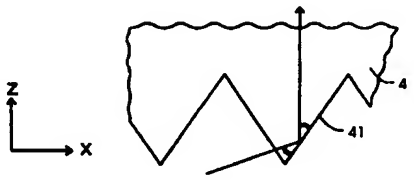
【符号の説明】

１　光源
２　光源リフレクタ
３　導光体
４　光偏向素子
５　反射素子
６　遮蔽材
２１　光入射面
２２　光入射対向面
２３　光出射面
２４　裏面
４１　入光面
４２　出光面

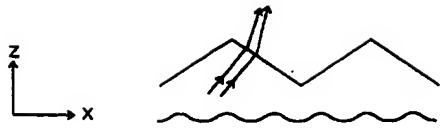
【図１】



【図２】



【図３】



【図４】